Form ESA-B4. Public Report for ESA-058-3
Final

Company	Owens Corning	**ESA Dates**	April 8-10, 2008
Plant	Eloy, Arizona	**ESA Type**	Compressed Air
Product		**ESA Specialist**	Frank Moskowitz

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction:
As an activity for the United States Department of Energy's Save Energy Now program, an Energy Savings Assessment (ESA) was performed at Owens Corning in Eloy Arizona. Owens Corning is a leading innovator of foam and glass fiber technology. The Eloy Arizona plant manufactures Insulation. The plant operates on a 52 week per year, 24 hour per day schedule, and 5 days per week. They have two furnaces, three fiberizers, four baggers and one transport system. Energy sources to the plant include electricity and natural gas.
The assessment, was conducted April 8th – 10th 2008, and was supported by plant maintenance leader, Ryan Jones and plant controller Dan Hardern. The ESA was led by DOE compressed air qualified specialist, Frank Moskowitz, of Draw Professional Services.

Objective of ESA:
The ESA had two main objectives. The first of these was to develop and present viable energy savings opportunities for the compressed air system; the second was to provide hands-on training and demonstration of the process of performing an energy savings assessment. To investigate energy savings opportunities, compressed air system power and pressure data were collected, LogTool was used to process the collected data and AIRMaster+ was used to model compressor energy use and potential energy efficiency measures (EEM's). These activities were performed in concert with site personnel in order to provide hands-on training.

Focus of the Assessment:
The assessment focused on the three compressors that were online and the pressure profile throughout the production area. This facility has four air compressors. A smaller Turbo centrifugal compressor, a larger Turbo Centrifugal, a lubricant injected rotary screw and another lubricant injected rotary screw. The larger Turbo was down for repairs during this ESA so the smaller Turbo plus both rotaries were online. The Turbo ran fully loaded and each rotary screw averaged 40-50% output regardless of demand due to some inoperative control components. Average flow therefore was approximately (1300 + 500 + 234) or about 2,000 cfm. The small turbo compressor fully loaded plus one rotary trimming is required to support production. However three compressors were at part load to supply this.

There are three receivers on the primary or supply side. There are no filters or dryers installed to remove contaminants from the air. As a result, there are many instances of water damage to end use components. Manual and electrically operated drains are the sole method of moisture removal in the distribution system and at the points of use.

Approach for ESA:
The general approach for this ESA included

- Review of compressed air distribution systems in the plant, including size and type of compressors
- Review of compressed air support equipment (filters and dryers)
- Discussion of end-uses in the plant
- Discussion of plant operating schedule and compressor operating schedule
- Measurement of compressor operating characteristics
- Brief measurement of compressor and distribution system operations
- Data analysis with LogTool
- Energy analysis with AIRMaster+, including development of EEM's

Plant personnel were given hands-on training using LogTool and AIRMaster+. Since site personnel will use their own data logging equipment, the DOE representative collected the data for this exercise under observation by plant personnel.

In order to collect the required 48 hours of data which LogTool requires to establish daytypes, all data collection was installed within the first few hours of arriving on site. Site personal were extremely helpful in accomplishing this task. A meeting was held that afternoon to introduce the concepts and routines of the next few days. The stated objective of developing and presenting compressed air EEM's (Energy Efficiency Measures) was accomplished by using compressor operating characteristic data measured during this ESA and using daytype information created by the LogTool software. Information was input to AIRMaster+ and EEM's were developed.

General Observations of Potential Opportunities:

- Note that energy saving opportunities are identified as Near Term, Medium Term, Long Term opportunities. See definitions below:

  - **<u>Near term</u>** opportunities would include actions that could be taken as improvements in operating practices, maintenance of equipment or relatively low cost actions or equipment purchases.
  - **<u>Medium term</u>** opportunities would require purchase of additional equipment and/or changes in the system such as addition of recuperative air preheaters and use of energy to substitute current practices of steam use etc. It would be necessary to carryout further engineering and return on investment analysis.
  - **<u>Long term</u>** opportunities would require testing of new technology and confirmation of performance of these technologies under the plant operating conditions with economic justification to meet the corporate investment criteria.

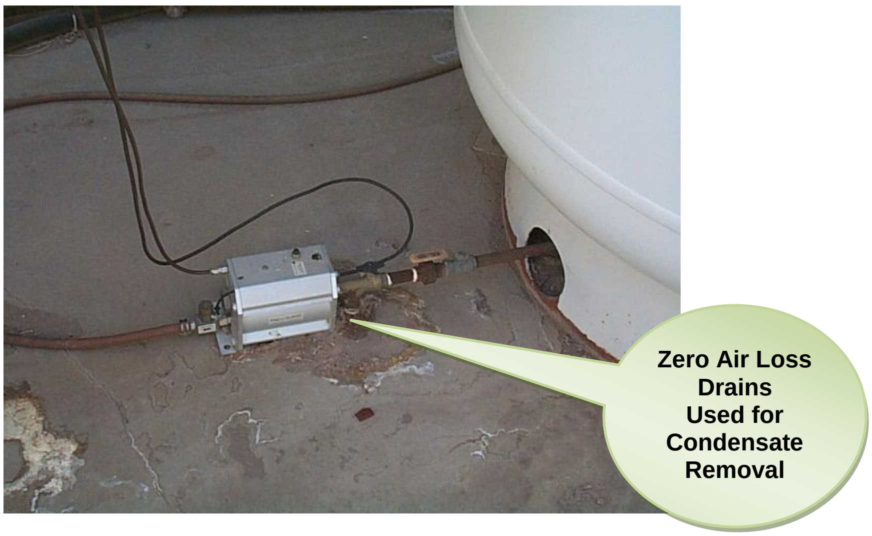
Opportunities Explained:

1. **<u>Add a VSD Compressor</u>**. The present demand requires about 2000 acfm of compressed air. The one turbo can output 1400 scfm which leaves 600 cfm in deficit. The current operating method is to allow all three compressors to share the load. The turbo can run very efficient fully loaded but the sharing is currently taking place by the smaller rotary screw compressors. They each are modulated back to share the remaining flow. The power each uses at 40 to 50% output is as high as 90%. This is why a **<u>VSD for a trim</u>** would be a method for energy reduction. A VSD rated for 1500 cfm or close to this will allow both rotary screws to be shut down. This will save 917,846 kWh per year.
2. **<u>Leak Reduction</u>**. With a very conservative 160 scfm leak reduction out of a possible 400 scfm gross leak load, a savings of 88,725 kWh per year would be the result of this effort.

Management Support and Comments:

DOE Contact at Plant/Company: Greg Banic
"The assessment team found **2 compressed air, energy savings projects** that have the potential to further reduce air consumption by 164 scfm and energy by 36% or 1,006,571 kilowatt-hours. The team estimated all projects could be implemented for $60,000 to $70,000 in capital costs at roughly a one year payback.

Best Practices Pictures:



Log Tool and Airmaster Energy Conclusions:

All three compressors were monitored under normal production with all fiberizers online. There was a problem with one furnace and all systems had to be shut down while being monitored. The Turbo goes from a steady 250 kW to a load noload sequence. One rotary screw went from 80 kW to an average of 73 kW. Only an 8% power reduction. The second rotary screw really didn't change as demand went away. It stayed at about 120 kW. Both rotary screws have control problems and could not operate properly as demand reduced. Plus the fact that they are both modulated inlet compressors, if their controls did indeed work properly they would both just continue to share the load with minimal energy reduction taking place.

The three compressors were outputting around 600 -800 scfm during this production stoppage. This would be a strong indicator that either the leak load is excessive or open blowing is still left on even during non productive times.

Energy Efficiency Measures from Airmaster

EEM of Add VSD and Fix Leaks

It is estimated that adding a VSD would save 917,846 kWh's and reducing the air leaks would save approximately 88,725 kWh's.

Additional Savings not included in Airmaster

The hot summer months will be here shortly. And, because of the rising temperatures, this mean an increase in condensation in the air system is inevitable. However until a dryer is purchased and installed, you can use a few basic rules to reduce Water:

- Water vapor will always move from an area of high relative humidity to an area of low relative humidity, regardless of the direction of air flow. Yes, an air leak can allow water vapor into the compressed air piping.
- Liquid water will always drain down by gravity, regardless of the direction of air flow. This sounds like common sense, but many people forget this when evaluating or installing piping and draining systems.
- Liquid water left to stand in air receivers, filter housings, etc., will evaporate into the dry air. This will raise the relative humidity and pressure dew point within the system, and carry liquids throughout the system.
- A drain leg in the piping system, ahead of downstream filters, will always improve the performance of the filter. The drain leg will remove any gross load before it has a chance to saturate the filter.
- Always use zero air loss or level activated drains at condensation drain locations.

Recommend not repairing the rotary screw and replacing it with an oil free rotary screw VSD in it's place. If the SCFM is in the 1300-1500 range then we can use the existing turbo or new VSD together. As leakage and end use optimization takes place at the plant, you might find that only the VSD could run all production.

A new refrigerated dryer and filter (not shown) is placed in line so that all running compressors flow through it. The single smaller rotary screw compressor should be removed or used for extreme emergency only. The 3 inch piping that runs throughout the demand side is very capable of handling all flows. Our data showed no measurable pressure drop or pressure gradients regardless of the demand.

Although OC Eloy is well aware of the water that condenses in the pipe line, they need to keep a good record of the dollars being spent on valve repair and downtime due to this contaminate. As with any water in a piping system, scale and rust will continue to build up and eventually choke down all end use lines to a point where they will not pass the required flow and production will stop. The inline dryer pictured above right is only made for the occasional hiccup in a system. It is not intended to be the dryer for every end use. On the next page is some help in justifying the purchase of a dryer.

Why dry air?

Any investment must be **justified by a suitable return**, and investing in quality air is no exception. However, when the benefits are quantified, it doesn't take long to see that the decision to invest is a simple one.

Without air treatment equipment, the contamination in the air will create corrosion in pipe work, cause premature pneumatic equipment failure and product spoilage. The air that surrounds us contains all kinds of particles and vapors. When this air is compressed the concentration of these contaminants increases dramatically, and in the case of an oil lubricated compressor, oil vapor is also added to the mixture.

Typically, the compression process causes the **oil and water vapors' to condense into droplets** that then mix with the high concentration of particles. The resulting mixture is an abrasive oily sludge that in many cases is also acidic. Although much of this will be removed by the after-cooler, about 1/3 will enter the air net if no further treatment is made. The pipe work that carries the compressed air is often forgotten when calculating the potential cost of poor quality air. Aggressive condensate will cause **corrosion leading to leaks**

Conclusion:

The Eloy Arizona plant is well on their way with improvements to their compressed air system. They learned about optimizing the compressed air system as well as proper maintenance that will afford them a very reliable system.

The Energy Savings Assessment (ESA) at the Eloy Owens Corning plant was a huge success. The benefits of the session will hopefully reach all management. Four people participated in the assessment. The team consisted of Manufacturing, Maintenance, Process and Technical Leaders.

During the session, participants:

- Received a compressed air training overview,
- Learned to use the DOE's software tools to identify energy-saving opportunities and to optimize their compressed air systems,
- Identified best practices that can be shared across the company,
- Identified and generated a list of energy-saving opportunities for the Eloy plant.